

ACTIVITY GROUP CAPITAL INVESTMENT JUSTIFICATION (Dollars in Thousands)							A. Budget Submission FY 2006 / FY 2007 BUDGET ESTIMATES					
B. Component/Activity Group/Date Department of the Navy Research and Development February 2005			C. Line No. & Item Description 1001. 43 Gigabit/sec Transmission Analyzer				D. Activity Identification Naval Research Laboratory Washington, DC 20375					
			FY 2004		FY 2005		FY 2006			FY 2007		
Element of Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost
Non-ADP Equipment (≥\$1M)										1	1,100	1,100
<p>Narrative Justification. This equipment will provide a unique DoD research capability to test the fidelity of Fiber-Optic (FO) digital communications systems. Future threats to SONET-based optical communication networks can be analyzed and addressed. SONET is a Synchronous Optical NETwork that allows data streams of different formats to be combined onto a single high-speed FO synchronous data stream. Transitioning from a 10 to 40 Gigabit per second (Gb/s) testing capability will provide a new and expanded R&D capability. Recent developments in phase encoding modulation formats have shown reduced susceptibility to cross-phase-modulation crosstalk. Together with advanced forward-error-correction techniques, recent experiments have successfully demonstrated 40 Gb/s transmission over Trans-Atlantic distances without the need for polarization-mode-dispersion compensation. This test equipment will allow NRL to examine FO systems and identify critical DOD specific needs and vulnerabilities to 40 Gb/s.</p> <p><u>Need/Requirement/Objective Statement:</u> Maximum bit rates for present operational scenarios are 2.4 Gb/s (near term) and 10 Gb/s (in 3 years) with systems using various intensity modulation formats. However, recent progress in phase encoded signaling formats have enabled long haul data transmission at rates up to 40 Gb/s. Economics will drive the deployment of 40 Gb/s systems in terms of transport cost-per-bit over 10 Gb/s systems. Due to the large commercial technology investment over the last 3 years, it now appears that development of 40 Gb/s systems is forthcoming. NRL is in a unique position being the only DoD laboratory with the expertise to address the security aspects of future 40 Gb/s systems. A number of R&D issues unique to the DoD's mission remain including: testing/understanding the effects of propagation nonlinearities, their impact on fiber type, and evaluation of the new phase-encoded modulation formats. This test equipment is critical to NRL's ability to determine the loss in signal fidelity as a function of transmission impairments - some of these impairments appear only as data rates exceed 20 Gb/s. This equipment will be used in the NRL recirculating loop testbed to expand the measurement capabilities to 40 Gb/s and allow for the investigation of propagation impairments, various signaling formats; quantify and investigate issues related to fiber nonlinearities; and to study the security aspects of higher bit rate systems.</p> <p><u>Workload Projections:</u> NRL's workload in SONET-based optical communications R&D is expected to increase over the next four years given that NRL continues to provide a leadership role in custom solutions for advanced communication systems.</p> <p><u>Alternative(s):</u> - Status Quo: NRL presently has testing capabilities only to 15 Gb/s. Without this equipment, custom measurement solutions will have to be designed and developed which would be too labor intensive to be practical. This acquisition is the only viable alternative to providing the capability to test OC-768 FO transmission systems. OC-768 is an optical carrier (OC) system running at a data rate 768 times faster than the base SONET rate of 51.83 Mb/s.</p>												

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Department of the Navy Research and Development February 2005		2001. Total Non-ADP (≥\$500K<\$1M)					Naval Research Laboratory Washington, DC 20375						
		FY 2004			FY 2005			FY 2006			FY 2007		
Element of Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	
Total Non-ADP (≥\$500K<\$1M)	3		2,246	4		2,710	4		2,540				
<p>Narrative Justification:</p> <p><u>FY 2004</u> Long Range Current Measurement System (LRCM) \$709,990 UAV Payload Testbed \$932,990 X-Band Reflector and Dual S/X Band Feed \$603,065</p> <p><u>FY 2005</u> Directed Energy Effects Test Facility \$600,000 Railgun Energy Storage Bank \$850,000 Spacecraft RF Subsystem Design & Test Instrumentation Upgrade \$750,000 X-Band Satellite Receiving System \$510,000</p> <p><u>FY 2006</u> Laser Ranging, Detection, & Imaging System (LRD) \$720,000 Millimeter Wave 110 GHz Network Analyzer \$520,000 Propulsion Test Station \$600,000 X-band Ground System Hardware \$700,000</p>													

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B. Component/Activity Group/Date		C. Line No. & Item Description					D. Activity Identification					
Department of the Navy Research and Development February 2005		1001. Common Data Link					Naval Research Laboratory Washington, DC 20375					
	FY 2004			FY 2005			FY 2006			FY 2007		
Element of Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost
Non-ADP Equipment (≥\$1M)										1	1,575	1,575
<p>Narrative Justification:</p> <p>This investment is to acquire a Common Data Link antenna with X-Band capabilities. As support to military operations by DoD's space systems have become pervasive in current warfighting doctrine, and is being incorporated more so for future operations. The technologies for interoperability, redundancy and security are being developed for incorporation into these space systems by NRL with pathfinder programs such as TacSat. Also, battlespace characterization technologies being developed by the research divisions of NRL, such as hyperspectral remote sensing, require significantly higher bandwidths for transmitting the battlescene to the warfighter. These technologies are being developed and demonstrated by NRL experimental satellites, and will incorporate X-band downlinks to satisfy the demand for higher data rates and more bandwidth. The antenna will provide command, telemetry, and housekeeping functions for future spacecraft being developed by NRL and other DoD laboratories which incorporate the X-band and CDL format. Future programs require a Common Data Link (CDL) to achieve a standard means of communications with airborne and space assets, thus providing interoperability and redundancy. X-band and CDL will provide this interoperability and the capability to handle high data rates. CDL is a full duplex, jam resistant spread spectrum, point-to-point digital microwave communications link. A very beneficial approach to developing a redundant path as well as a simultaneous X-band operational capability, is to acquire a CDL. The CDL provides interoperability with other DOD assets. In addition, the CDL provides NRL with the redundancy of a second X-band antenna along with its' associated data path consisting of downconverter, receiver, bit sync and FEP. When complete, NRL will have CDL capability; one multi feed (L/S and X band) antenna; one X-band only antenna; and all the LNA's down converters, receivers, bit synchronizers and front end processor for the X band path.</p> <p>The two alternatives to purchasing the X-band feed and associated data path components are not acceptable. They are: (1) doing nothing, and thus losing the capabilities of NRL for future X-band satellite support and, (2) lease services from an X-band provider. Because, most DOD programs require encrypted space-to-ground links, this is not considered a viable alternative.</p>												

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B. Component/Activity Group/Date Department of the Navy Research and Development February 2005		C. Line No. & Item Description 5001. Total ADP (≥\$500K<\$1M)					D. Activity Identification Naval Research Laboratory Washington, DC 20375					
	FY 2004			FY 2005			FY 2006			FY 2007		
Element of Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost
Total ADP (≥\$500K<\$1M)										1		500
Narrative Justification: <u>FY 2007</u> Shared Memory Computing System \$500,000												

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B. Component/Activity Group/Date		C. Line No. & Item Description					D. Activity Identification					
Department of the Navy Research and Development February 2005		8001. Total Minor Construction (≥\$500K<\$1M)					Naval Research Laboratory Washington, DC 20375					
	FY 2004			FY 2005			FY 2006			FY 2007		
Element of Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost
Total Minor Construction (≥\$500K<\$1M)	2		1,284	3		1,850	2		1,500	2		1,500
<p>Narrative Justification:</p> <p><u>FY 2004</u> Communications Distribution Modernization \$534,000 Photonics Technology Facility \$750,000</p> <p><u>FY 2005</u> Enclose Warehouse Structure for Technical Information Services \$500,000 Midway Research Center Perimeter Fence \$600,000 Renovate Acoustic Tank Area \$750,000</p> <p><u>FY 2006</u> Chemistry Facility Modernization \$750,000 Optical Physics Facility Modifications \$750,000</p> <p><u>FY 2007</u> Hazardous Materials Minimization Center \$750,000 Space Systems Technology Facility \$750,000</p>												

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	FY 2004			FY 2005			FY 2006			FY 2007		
Element of Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost	Quan	Unit Cost	Total Cost
Total Minor Construction (<\$500K)	2		566				2		500	2		500
Narrative Justification:												